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HEAT DISSIPATING/BUFFERING STRUCTURE FOR SUBMARINE REPEATER

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[There are no amendments to this patent.]

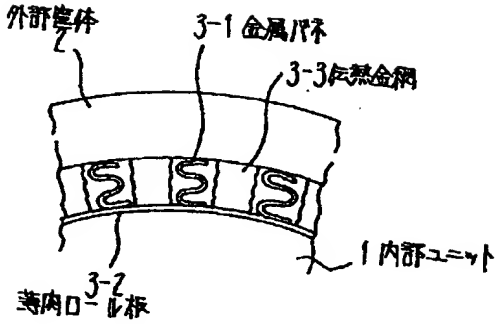
Abstract

Objective

The objective of this invention is to realize a structure that transfers heat at a high efficiency from within an internal unit to an outer housing and to realize a structure that can buffer vibration of the internal unit.

Constitution

Thin rolled sheet (3-2) that has fixed on it plural metal springs (3-1) formed in a wavy shape and in contact with the outer housing is set in the gap between cylindrical internal unit (1) and outer housing (2). Also, thermoconductive metal meshes having elasticity are set between wavy metal springs (3-1). The two ends of internal unit (1) are fixed inside the outer housing via retainers (5) of conical springs (4). With this configuration, it is possible to maintain high-efficiency thermal conduction between the internal unit and the outer housing, and, at the same time, a constant temperature distribution can be maintained over the entire circumference between the internal unit and the outer housing. Also, impacts in the circumferential direction can be absorbed by the metal springs and thermoconductive metal meshes arranged to cover the entire circumference of the internal unit, while impacts in the axial direction can be absorbed by the conical springs.



Key: 1 Internal unit
2 Outer housing
3-1 Metal spring
3-2 Thin rolled sheet
3-3 Thermoconductive metal mesh

Claims

1. A heat dissipating/buffering structure for a submarine repeater characterized by the following facts: the heat dissipating/buffering structure for the submarine repeater has a cylindrical internal unit that contains a circuit unit in it and has its periphery coated with an insulating layer, and has a heat dissipating/buffering portion that displays a buffer function while dissipating heat between the aforementioned internal unit and an outer housing which contains the internal unit; in this heat dissipating/buffering structure, the aforementioned heat dissipating/buffering portion is composed of a thin rolled sheet set on the outer periphery of the aforementioned internal unit, metal springs formed in a wavy shape and set on the rolled sheet, and thermoconductive metal meshes set between the metal springs.

2. The heat dissipating/buffering structure for the submarine repeater described in Claim 1 characterized by the fact that the aforementioned thermoconductive metal meshes are elastic.

3. A heat dissipating/buffering structure for a submarine repeater characterized by the following facts: the heat dissipating/buffering structure for the submarine repeater has a cylindrical internal unit, an outer housing with the internal unit set inside it, a rolled sheet set on the outer periphery of the aforementioned internal unit, wavy metal springs set on the rolled sheet, thermoconductive metal meshes set between the metal springs, and fixing spring members for fixing the aforementioned internal unit in the axial direction of the aforementioned outer housing with elasticity.

Detailed explanation of the invention

[0001]

Industrial application field

This invention pertains to a heat dissipating/buffering structure for a submarine repeater. In particular, this invention pertains to a heat dissipating/buffering structure for a submarine repeater characterized by the fact that it can realize a reliable heat dissipating effect for an internal unit without requiring particularly high dimensional precision.

[0002]

Prior art

Figure 4(a) is a longitudinal cross-sectional view of an example of a conventional heat dissipating/buffering structure for a submarine repeater, and Figure 4(b) is an enlarged oblique view of the heat dissipating member portion.

[0003]

In a conventional heat dissipating/buffering structure for a submarine repeater of this type, heat dissipating member (11) formed in cylindrical shape is set at the central portion of the outer periphery of internal unit (1) and between [the internal unit] and outer housing (2). Rubber cushions (10) are attached on the two ends of internal unit (1) with the aid of retainers (5). In this structure, vibration and impact transferred to the internal unit are buffered by rubber cushions (10) on the two ends. Also, as shown in Figure 4, heat dissipating member (11) is composed of plural semi-arc-shape heat dissipating plates (12) and thin rolled sheet (13) set on the outer periphery. The overall thickness of heat dissipating member (11) including the thickness of semi-arc-shape [heat dissipating plates] and the thickness of thin rolled sheet (13) is selected to be larger than the gap between internal unit (1) and outer housing (2) so that these contact each other for transfer of heat reliably from within internal unit (1) to outer housing (2).

[0004]

Problems to be solved by the invention

In the aforementioned conventional heat dissipating/buffering structure for a submarine repeater, heat generated by internal unit (1) is transferred by heat dissipating member (11) to outer housing (2). However, when heat dissipating member (11) is installed on internal unit (1) and inserted together with rubber cushions into outer housing (2), due to fine bumps and dips on the srface of internal unit (1), twist and deformation of the heat dissipating plates, etc., gaps develop at the contact plane, leading to a decrease in heat dissipating efficiency. This is undesired. In particular, when the heat generating rate is high, temperature rise inside the internal unit may not be suppressed sufficiently. This is a problem.

[0005]

Also, in order to ensure reliable contact with the outer housing, it is necessary to strictly control dimensions so that the thickness dimension of the heat dissipating member is a little larger than the gap between the internal unit and the outer housing. In addition, in order to realize the desired characteristics, it is necessary to increase the number of heat dissipating fins, so that the cost of member processing is increased. This is also a disadvantage.

[0006]

In addition, rubber cushions are attached on the two ends of the internal unit. However, as the thermal conductivity of rubber cushions is lower than that of the heat dissipating member, the heat dissipating efficiency decreases. Consequently, a significant difference takes place in the heat dissipating high price [sic; rate] between the central portion and the two end portions of the internal unit.

[0007]

Also, heat of the heat generating member inside the internal unit is transferred from the surface of the heat dissipating member to the surrounding space. However, heat stagnation takes place in the space located between heat dissipating plates. Such stagnant heat is concentrated on a portion of the surface of the outer housing while it is dissipated to the surrounding environment. Consequently, the efficiency is poor.

[0008]

The objective of this invention is to solve the aforementioned problems of conventional methods by providing a heat dissipating/buffering structure that can transfer heat of the internal unit to the outer housing at a high efficiency.

[0009]

Means to solve the problems

In order to realize the aforementioned objective, this invention provides a heat dissipating/buffering structure for a submarine repeater characterized by the following facts: the heat dissipating/buffering structure for a submarine repeater has a cylindrical internal unit that contains a circuit unit in it and has its periphery coated with an insulating layer, and has a heat dissipating/buffering portion that displays a buffer function while dissipating heat between the aforementioned internal unit and an outer housing which contains the internal unit; in this heat dissipating/buffering structure, a thin rolled sheet having plural metal springs formed in a wavy shape fixed on it and in contact with the outer housing in the axial direction or circumferential direction is set in the gap between the aforementioned internal unit and the aforementioned outer housing, and elastic thermoconductive metal meshes are set between the metal springs.

[0010]

Application example

In the following, this invention will be explained in detail with reference to figures.

[0011]

Figure 1 is a longitudinal cross-sectional view illustrating an application example of this invention. Figure 2 is a cross-sectional view illustrating a portion of the main portion of Figure 1. Figures 3(a) and (b) illustrate effects of this invention. As shown in Figures 1 and 2, the heat dissipating/buffering structure of this invention is composed of internal unit (1), outer housing (2), heat dissipating/buffering structure (3), conical springs (4), retainers (5), and plates (6). Heat dissipating member (3) is composed of thin rolled sheet (3-2) having fixed on it plural metal springs (3-1) formed in a wavy shape and in contact with outer housing (2), and elastic and thermoconductive metal meshes (3-3) set between thin rolled sheet (3-2) and said wavy metal springs (3-1).

[0012]

Internal unit (1) is a cylindrical unit that has a circuit unit contained in it and has its outer periphery coated with an insulating layer made of a polyethylene sealant or the like. Internal unit (1) is held in cylindrical outer housing (2) by means of thin rolled sheet (3-2) that has metal springs (3-1) formed in a wavy shape, as well as conical springs (4), retainers (5) and plates (6).

[0013]

For vibration and impact on the internal unit, impact applied in the circumferential direction is absorbed by said thin rolled sheet (3-2), and impact applied in the axial direction is absorbed by conical springs (4). Thermoconductive metal meshes (3-3) inserted between wavy metal springs (3-1) transfer heat generated in internal unit (1) to the outer housing and simultaneously have a structure prepared by sewing elastic metal wires formed in a wavy shape to ensure good contact between the outer periphery of internal unit (1) and the inner periphery of outer housing (2).

[0014]

Elastic metal meshes (3-3) have numerous contact points with thin rolled sheet (3-2) installed on internal unit (1) and with outer housing (2). As a result, as shown in Figure 3, metal meshes (3-3) with a thermal conductivity that is more than 10 fold that of the heat dissipating plates alone are set, so that thermal conduction can be performed at high efficiency and uniformly on the entire circumference.

[0015]

Effect of the invention

As explained above, according to this invention, by setting thin rolled sheet having fixed on it plural metal springs formed in a wavy shape and in contact with the outer housing as well as elastic and conductive metal meshes in the gap between a cylindrical internal unit and an outer housing, it is possible to maintain a high efficiency for thermal conduction between the internal unit and the outer housing.

[0016]

In a conventional heat dissipating/buffering structure, heat dissipating fins are set on the periphery of the central portion of influence, and rubber cushions are attached on the two end portions. In this case, the heat dissipating effect is uneven between the central portion and the two end portions of the internal unit. On the other hand, in this invention, a thin rolled sheet with metal springs fixed on it and thermoconductive metal meshes are applied to cover the entire periphery of the cylinder of the internal unit. Consequently, temperature distribution is uniform over the entire periphery of the internal unit.

Brief description of the figures

Figure 1 is a longitudinal cross-sectional view illustrating an application example of this invention.

Figure 2 is a cross-sectional view illustrating a portion of Figure 1.

Figures 3(a) and (b) illustrate effects of this invention.

Figure 4(a) is a longitudinal cross-sectional view illustrating an example of a conventional heat dissipating/buffering structure for a submarine repeater. Figure 4(b) is an enlarged oblique view illustrating a portion of the heat dissipating member.

Figures 5(a) and (b) illustrate heat flow in the prior art.

Brief description of part numbers

1	Internal unit
2	Outer housing
3	Heat dissipating/buffering member
3-1	Metal spring
3-2	Thin rolled sheet
3-3	Thermoconductive metal mesh
4	Conical spring
5	Retainer
6	Plate
7	Heat generating member
10	Rubber cushion
11	Heat dissipating member
12	Heat dissipating plate
13	Thin rolled sheet

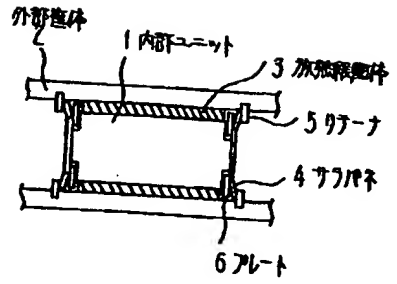


Figure 1

Key:
1 Internal unit
2 Outer housing
3 Heat dissipating/buffering member
4 Conical spring
5 Retainer
6 Plate

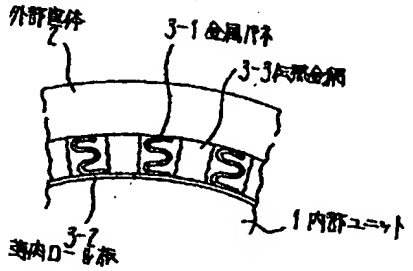


Figure 2

Key:
1 Internal unit
2 Outer housing
3-1 Metal spring
3-2 Thin rolled sheet
3-3 Thermoconductive metal mesh

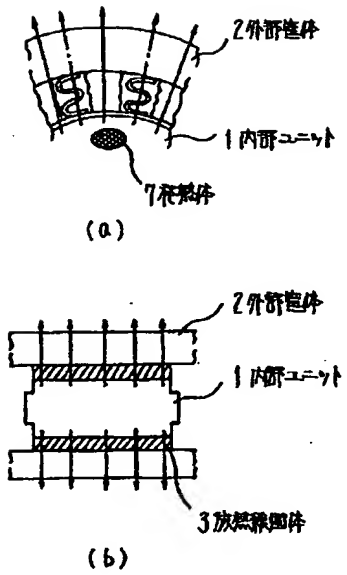
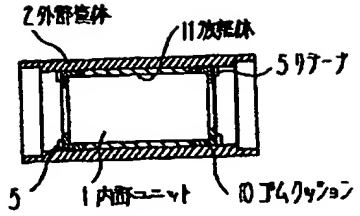
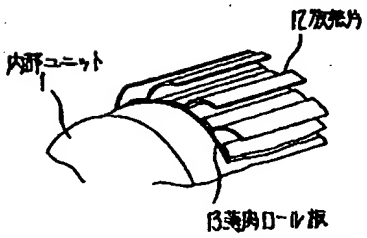


Figure 3

Key:
1 Internal unit
2 Outer housing
3 Heat dissipating/buffering member
7 Heat generating member



(a)



(b)

Figure 4

Key:
1 Internal unit
2 Outer housing
5 Retainer
10 Rubber cushion
11 Heat dissipating member
12 Heat dissipating plate
13 Thin rolled sheet

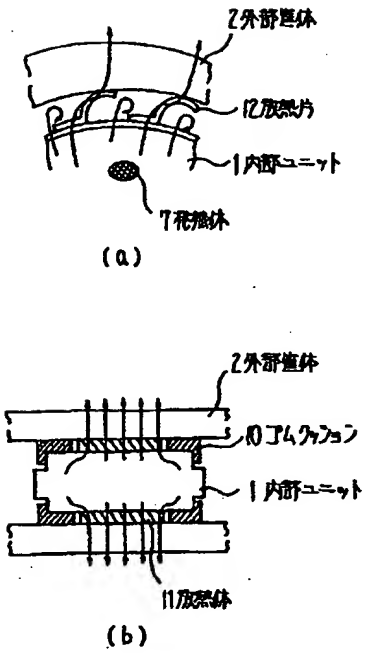


Figure 5

Key:
1 Internal unit
2 Outer housing
7 Heat generating member
10 Rubber cushion
11 Heat dissipating member
12 Heat dissipating plate